JOURNAL OF THEORETICAL BIOLOGY

Co-Chief Editors: S. A. KAUFFMAN
L. WOLPERT

Editorial Board: N. BARTON
J. BONNER
B. CHARLESWORTH
A. CORNISH-BOWDEN
J. COWAN
F. DYSON
D. GARFINKEL
M. E. GILPIN
L. GLASS
A. GOLDBETER
B. GOODWIN
M. HASSALL
P. W. HEDRICK
M. KARPLUS
T. B. L. KIRKWOOD
J. H. LEWIS
R. C. LEWONTIN
W. R. LIEB
R. B. LUFTIG
R. M. MAY
J. MAYNARD SMITH
J. D. MURRAY
T. OHTA
H. H. PATTEE
A. S. PERELSON
S. L. PIMM
J. RINZEL
M. SAVAGEAU
P. SCHUSTER
J. H. STEINBACH
T. TAKENAKA
J. TYSON
J. Z. YOUNG

VOLUME 141
November–December 1989

ACADEMIC PRESS
London San Diego New York Boston
Sydney Tokyo Toronto

Copyright © 1990, by Academic Press Limited

ALL RIGHTS RESERVED

No part of this volume may be reproduced in any form, by photostat, microfilm, or any other means, without written permission from the publishers.

Printed in Great Britain

Contents for Volume 141

Number 1, 8 November 1989

HICKSON, R. E., Self-Splicing Introns as a Source for Transposable Genetic Elements 1

AOKI, I., Entropy Flow and Entropy Production in the Human Body in Basal Conditions 11

YOUNG, R. A. and MARROCCO, R. T., Predictions About Chromatic Receptive Fields Assuming Random Cone Connections 23

YUAN, C. J., HOPFINGER, A. J. and JOHNSON, M. E., QSAR and Molecular Shape Analysis of Aryl-substituted Alanine Analogs as Antigelling Agents 41

SÜHNEL, J., Modeling Survival of Experimentally Virus-infected Laboratory Animals—Exploration of the Survival Diagram 53

HALLAM, T. G. and HUANG, Y., On the Dynamics of a Toxicant-individual System 65

O'QUIGLEY, J., WARD, P. and NASH, R., Estimating the Size of the Dividing Stem Cell Pool After Allogenic Bone Marrow Transplantation . . 73

NEE, S., Does Hamilton's Rule Describe the Evolution of Reciprocal Altruism? 81

SAVAGEAU, M. A. and SORRIBAS, A., Constraints Among Molecular and Systemic Properties: Implications for Physiological Genetics . . 93

TAKAHASHI, M., A Fractal Model of Chromosomes and Chromosomal DNA Replication 117

LETTER TO THE EDITOR

PHILLIPS, D. D. and HUBBARD, S. F., Controlled Covariance in the Atkinson-Shorrocks Model of Multispecies Competition . . 137

Number 2, 21 November 1989

BACHOUCHI, N. and MOREL, J. E., Behaviour of the Crossbridges in Stretched or Compressed Muscle Fibres 143

SCHIERWAGEN, A., A Non-uniform Equivalent Cable Model of Membrane Voltage Changes in a Passive Dendritic Tree 159

CANALS, M., ROSENMANN, M. and BOZINOVIC, F., Energetics and Geometry of Huddling in Small Mammals 181

ARMSTRONG, R. A., Competition, Seed Predation, and Species Coexistence 191

NEWMAN, J. A. and CARACO, T., Co-operative and Non-co-operative Bases of Food-Calling 197

KAUFFMAN, S. A. and WEINBERGER, E. D., The *NK* Model of Rugged Fitness Landscapes and Its Application to Maturation of the Immune Response 211

DHANOA, M. S., FRANCE, J. and SIDDONS, R. C., On Using a Double-exponential Model for Describing Faecal Marker Concentration Curves 247

PICKARD, W. F., How might a Tracheary Element which is Embolized by Day be Healed by Night? 259

LETTER TO THE EDITOR

PAPAGEOGIOU, S., Cartesian or Polar Co-ordinates in Pattern Formation? 281

Number 3, 7 December 1989

BHIMARAO, C. and JOSHI, R. R., On Antigen–Antibody Binding Distribution 285

JEJE, A. and KOON, D., An Analysis on the Rates and Regulation of Insensible Water Loss Through the Eccrine Sweat Glands 303

BLEECKEN, S., Model for the Feedback Control System of Bacterial Growth II. Growth in Continuous Culture 325

IANNACCONE, P. M., BERKWITS, L., JOGLAR, J., LINDSAY, J. and LUNDE, A., Probabilistic Division Systems Modeling the Generation of Mosaic Fields 363

SUKHODOLETS, V. V., The Genetic Code as a Clue to Understanding of Molecular Evolution 379

KOCH, A. L., The Origin of the Rotation of One End of a Cell Relative to the Other End During Growth of Gram-positive Rods 391

SULSKY, D., VANCE, R. R. and NEWMAN, W. I., Time Delays in Age-Structured Populations 403

KYPR, J. and MRÁZEK, J., Reading Frames of HIV Genes 423

LETTER TO THE EDITOR

BACHOUCHI, N. and MOREL, J. E., Muscle Contraction and *In Vitro* Movements 425

Number 4, 19 December 1989

WHITE, R. A., Computing Multiple Cell Kinetic Properties from a Single Time Point 429

KEASLING, J. D. and PALSSON, B. O., ColE1 Plasmid Replication: A Simple Kinetic Description from a Structured Model 447

OSTER, G. F., CHENG, L. Y., MOORE, H.-P. H. and PERELSON, A. S., Vesicle Formation in the Golgi Apparatus 465

DEXTER, F., SAIDEL, G. M. and RUDY, Y., Simulation of the Diffusion of Acetylcholine in the Neuroeffector Junctions of the Sinus Node . 505

JOSHI, A. and PALSSON, B. O., Metabolic Dynamics in the Human Red Cell. Part I—A Comprehensive Kinetic Model 515

JOSHI, A. and PALSSON, B. O., Metabolic Dynamics in the Human Red Cell. Part II—Interactions with the Environment 529

SPEAKMAN, J. R. and RACEY, P. A., Doubly Labelled Water: Errors in the Evaluation of Oxygen Isotope Turnover due to Temporal Variation in CO_2 Production do not Always Covary with Dilution Space Estimate 547

HOROVITZ, A. and LEVINE, R. D., Knowledge-based Predictions of Binding Constants for Engineered Enzymes 557

JOLICOEUR, P. and PONTIER, J., Population Growth and Decline: a Four-Parameter Generalization of the Logistic Curve 563

Index to Volume 141

Acetylcholine diffusion in the neuroeffector junctions of the sinus node, simulation of, 505
Age-structured populations, time delays in, 403
Alanine analogs, aryl-substituted, as antigelling agents, QSAR and molecular shape analysis of, 41
Altruism, reciprocal, does Hamilton's Rule describe the evolution of?, 81
Animals, laboratory, experimentally virus-infected, modeling survival of, 53
Antigelling agents, QSAR and molecular shape analysis of aryl-substituted alanine analogs as, 41
Antigen-antibody binding distribution, 285
AOKI, I., Entropy flow and entropy production in the human body in basal conditions, 11
ARMSTRONG, R. A., Competition, seed predation, and species coexistence, 191
Aryl-substituted alanine analogs as antigelling agents, QSAR and molecular shape analysis of, 41
Atkinson-Shorrocks model of multispecies competition, controlled covariance in (letter), 137

BACHOUCHI, N. and MOREL, J. E., Behaviour of the crossbridges in stretched or compressed muscle fibres, 143
BACHOUCHI, N. and MOREL, J. E., Muscle contraction and *in vitro* movements (letter), 425
Bacterial growth in continuous culture, a model for the feedback control system of, 325
BERKWITS, L. (see IANNACCONE, P. M.), 363
BHIMARAO, C. and JOSHI, R. R., On antigen-antibody binding distribution, 285
Binding, antigen-antibody; distribution, 285
Binding constants for engineered enzymes, knowledge-based predictions of, 557
BLEECKEN, S., Model for the feedback control system of bacterial growth. II. Growth in continuous culture, 325
Body, human, in basal conditions, entropy flow and entropy production in, 11
Bone marrow transplantation, estimating the size of the dividing stem cell pool after, 73
BOZINOVIC, F. (see CANALS, M.), 181

CANALS, M., ROSENMANN, M. and BOZINOVIC, F., Energetics and geometry of huddling in small mammals, 181
CARACO, T. (see NEWMAN, J. A.), 197
CO_2 production and errors in the evaluation of oxygen isotope turnover; doubly labelled water, 547
Cell, multiple, kinetic properties computed from a single time point, 429
Cell: the origin of the rotation of one end relative to the other during growth of Gram-positive rods, 391
Cell pool, stem, dividing, after allogenic bone marrow transplantation, estimating the size of, 73
Cell, red, human, metabolic dynamics; interactions with the environment, 529
Cell, red, human, metabolic dynamics; a kinetic model, 515
CHENG, L. Y. (see OSTER, G. F.), 465
Chromatic receptive fields, predictions about, assuming random cone connections, 23
Chromosomes and chromosomal DNA replication, a fractal model of, 117
Coexistence of species; seed predation; competition, 191
ColE1 plasmid replication: a simple kinetic description from a structured model, 447
Competition, multispecies, controlled covariance in the Atkinson-Shorrocks model of (letter), 137

Competition, seed predation, and species coexistence, 191
Cone connections, random, assumed in predictions about chromatic receptive fields, 23
Constraints among molecular and systemic properties: implications for physiological genetics, 93
Controlled covariance in the Atkinson–Shorrocks model of multispecies competition (letter), 137
Co-operative and non-co-operative bases of food-calling, 197
Co-ordinates, cartesian or polar, in pattern formation? (letter), 281
Crossbridges in stretched or compressed muscle fibres, behaviour of, 143

DEXTER, F., SAIDEL, G. M. and RUDY, Y., Simulation of the diffusion of acetylcholine in the neuroeffector junctions of the sinus node, 505
DHANOA, M. S., FRANCE, J. and SIDDONS, R. C., On using a double-exponential model for describing faecal marker concentration curves, 247
Diffusion of acetylcholine in the neuroeffector junctions of the sinus node, simulation of, 505
Dividing stem cell pool after allogenic bone marrow transplantation, estimating the size of, 73
DNA replication, chromosomal, a fractal model of chromosomes and, 117
Dynamics of a toxicant-individual system, 65

Eccrine sweat glands, the rates and regulation of insensible water loss through, 303
Energetics and geometry of huddling in small mammals, 181
Engineered enzymes, knowledge-based predictions of binding constants for, 557
Entropy flow and entropy production in the human body in basal conditions, 11
Enzymes, engineered, knowledge-based predictions of binding constants for, 557
Evolution, molecular, the genetic code as a clue to understanding of, 379
Evolution of reciprocal altruism, does Hamilton's Rule describe?, 81

Faecal marker concentration curves, on using a double-exponential model for, 247
Feedback control system model of bacterial growth in continuous culture, 325
Fields, mosaic, probabilistic division systems modeling the generation of, 363
Fields, receptive, chromatic, predictions about, assuming random cone connections, 23
Food-calling, co-operative and non-co-operative bases of, 197
Fractal model of chromosomes and chromosomal DNA replication, 117
FRANCE, J. (see DHANOA, M. S.), 247

Genes, HIV, reading frames of, 423
Genetic code as a clue to understanding of molecular evolution, 379
Genetic elements, transposable, self-splicing introns as a source for, 1
Genetics, physiological; implications of constraints among molecular and systemic properties, 93
Golgi apparatus, vesicle formation in, 465
Gram-positive rods, the origin of the rotation of one end of a cell relative to the other end during growth of, 391
Growth, bacterial, in continuous culture, a model for the feedback control system of, 325
Growth and decline of population: a four-parameter generalization of the logistic curve, 563
Growth of Gram-positive rods, the origin of the rotation of one end of a cell relative to the other end during, 391

HALLAM, T. G. and HUANG, Y., On the dynamics of a toxicant-individual system, 65
Hamilton's Rule: does it describe the evolution of reciprocal altruism?, 81
HICKSON, R. E., Self-splicing introns as a source for transposable genetic elements, 1
HIV genes, reading frames of, 423
HOPFINGER, A. J. (see YUAN, C. J.), 41

HOROVITZ, A. and LEVINE, R. D., Knowledge-based predictions of binding constants for engineered enzymes, 557
HUANG, Y. (see HALLAM, T. G.), 65
HUBBARD, S. F. (see PHILLIPS, D. D.), 137
Huddling in small mammals, energetics and geometry of, 181
Human body in basal conditions, entropy flow and entropy production in, 11
Human red cell metabolic dynamics; interactions with the environment, 529
Human red cell metabolic dynamics; a kinetic model, 515

IANNACCONE, P. M., BERKWITS, L., JOGLAR, J., LINDSAY, J. and LUNDE, A., Probabilistic division systems modeling the generation of mosaic fields, 363
Immune response, the NK model of rugged fitness lanscapes and its application to maturation of, 211
Introns, self-splicing, as a source for transposable genetic elements, 1

JEJE, A. and KOON, D., An analysis on the rates and regulation of insensible water loss through the eccrine sweat glands, 303
JOGLAR, J. (see IANNACCONE, P. M.), 363
JOHNSON, M. E. (see YUAN, C. J.), 41
JOLICOEUR, P. and PONTIER, J., Population growth and decline: a four-parameter generalization of the logistic curve, 563
JOSHI, A. and PALSSON, B. O., Metabolic dynamics in the human red cell. Part I. A comprehensive kinetic model, 515
JOSHI, A. and PALSSON, B. O., Metabolic dynamics in the human red cell. Part II. Interactions with the environment, 529
JOSHI, R. R. (see BHIMARAO, C.), 285

KAUFFMAN, S. A. and WEINBERGER, E. D., The *NK* model of rugged fitness landscapes and its application to maturation of the immune response, 211
KEASLING, J. D. and PALSSON, B. O., ColE1 plasmid replication: a simple kinetic description from a structured model, 447
Kinetic description of ColE1 plasmid replication, from a structured model, 447
Kinetic properties, multiple cell, computed from a single time point, 429
KOCH, A. L., The origin of the rotation of one end of a cell relative to the other end during growth of Gram-positive rods, 391
KOON, D. (see JEJE, A.), 303
KYPR, J. and MRÁZEK, J., Reading frames of HIV genes, 423

LEVINE, R. D. (see HOROVITZ, A.), 557
LINDSAY, J. (see IANNACCONE, P. M.), 363
LUNDE, A. see IANNACCONE, P. M.), 363

Mammals, small, energetics and geometry of huddling in, 181
MARROCCO, R. T. (see YOUNG, R. A.), 23
Membrane voltage changes in a passive dendritic tree, a non-uniform equivalent cable model of, 159
Metabolic dynamics in the human red cell; interactions with the environment, 529
Metabolic dynamics in the human red cell; a kinetic model, 515
Molecular evolution, the genetic code as a clue to understanding of, 379
Molecular shape analysis of aryl-substituted alanine analogs as antigelling agents, and QSAR, 41
Molecular and systemic properties, constraints among; implications for physiological genetics, 93
MOORE, H.-P. H. (see OSTER, G. F.), 465

MOREL, J. E. (see BACHOUCHI, N.), 143, 425
Mosaic fields, probabilistic division systems modeling the generation of, 363
Movements, *in vitro*, and muscle contraction (letter), 425
MRÁZEK, J. (see KYPR, J), 423
Multispecies competition, controlled covariance in the Atkinson–Shorrocks model of (letter), 137
Muscle contraction and *in vitro* movements (letter), 425
Muscle fibres, stretched or compressed, behaviour of the crossbridges in, 143

NASH, R. (see O'QUIGLEY, J.), 73
NEE, S., Does Hamilton's Rule describe the evolution of reciprocal altruism?, 81
Neuroeffector junctions of the sinus node, simulation of the diffusion of acetylcholine in, 505
NEWMAN, J. A. and CARACO, T., Co-operative and non-co-operative bases of food-calling, 197
NEWMAN, W. I. (see SULSKY, D.), 403
NK model of rugged fitness landscapes and its application to maturation of the immune response, 211

O'QUIGLEY, J., WARD, P. and NASH, R., Estimating the size of the dividing stem cell pool after allogenic bone marrow transplantation, 73
OSTER, G. F., CHENG, L. Y., MOORE, H.-P. H. and PERELSON, A. S., Vesicle formation in the Golgi apparatus, 465
Oxygen isotope turnover and temporal variation in CO_2 production; doubly labelled water, 547

PALSSON, B. O. (see JOSHI, A.), 515, 529
PALSSON, B. O. (see KEASLING, J. D.), 447
PAPAGEOGIOU, S., Cartesian or polar co-ordinates in pattern formation? (letter), 281
Pattern formation, cartesian or polar co-ordinates in? (letter), 281
PERELSON, A. S. (see OSTER, G. F.), 465
PHILLIPS, D. D. and HUBBARD, S. F., Controlled covariance in the Atkinson–Shorrocks model of multispecies competition (letter), 137
Physiological genetics: implications of constraints among molecular and systemic properties, 93
PICKARD, W. F., How might a tracheary element which is embolized by day be healed by night?, 259
Plasmid, ColE1, replication: a simple kinetic description from a structured model, 447
PONTIER, J. (see JOLICOEUR, P.), 563
Populations, age-structured, time delays in, 403
Population growth, and decline: a four-parameter generalization of the logistic curve, 563
Predation, seed, and species coexistence, 191
Probabilistic division systems modeling the generation of mosaic fields, 363

QSAR and molecular shape analysis of aryl-substituted alanine analogs as antigelling agents, 41

RACEY, P. A. (see SPEAKMAN, J. R.), 547
Reading frames of HIV genes, 423
Regulation of insensible water loss through the eccrine sweat glands, 303
Replication, ColE1 plasmid; a simple kinetic description from a structured model, 447
Replication, DNA, chromosomal, a fractal model of chromosomes and, 117
ROSENMANN, M. (see CANALS, M.), 181
Rotation of one end of a cell relative to the other end during growth of Gram-positive rods, the origin of, 391

RUDY, Y. (see DEXTER, F.), 505
Rugged fitness landscapes, the *NK* model of, and its application to maturation of the immune response, 211

SAIDEL, G. M. (see DEXTER, F.), 505
SAVAGEAU, M. A. and SORRIBAS, A., Constraints among molecular and systemic properties: implications for physiological genetics, 93
SCHIERWAGEN, A., A non-uniform equivalent cable model of membrane voltage changes in a passive dendritic tree, 159
Seed predation, competition, and species coexistence, 191
Self-splicing introns as a source for transposable genetic elements, 1
SIDDONS, R. C. (see DHANOA, M. S.), 247
Sinus node, simulation of the diffusion of acetylcholine in the neuroeffector junctions of, 505
SORRIBAS, A. (see SAVEGEAU, M. A.), 93
SPEAKMAN, J. and RACEY, P. A., Doubly labelled water: errors in the evaluation of oxygen isotope turnover due to temporal variation in CO_2 production do not always covary with dilution space estimate, 547
SÜHNEL, J., Modeling survival of experimentally virus-infected laboratory animals—exploration of the survival diagram, 53
SUKHODOLETS, V. V., The genetic code as a clue to understanding of molecular evolution, 379
SULSKY, D., VANCE, R. R. and NEWMAN, W. I., Time delays in age-structured populations, 403
Survival of experimentally virus-infected laboratory animals, modeling of, 53
Sweat glands, eccrine, the rates and regulation of insensible water loss through, 303

TAKAHASHI, M., A fractal model of chromosomes and chromosomal DNA replication, 117
Time delays in age-structured populations, 403
Time point, single, computing multiple cell kinetic properties from, 429
Toxicant-individual system on the dynamics of, 65
Tracheary element embolized by day: how might it be healed by night?, 259
Transplantation, bone narrow, estimating the size of the dividing stem cell pool after, 73
Tree, dendritic, passive, a non-uniform equivalent cable model of membrane voltage changes in, 159

VANCE, R. R. (see SULSKY, D.), 403
Vesicle formation in the Golgi apparatus, 465
Virus-infected laboratory animals, modeling survival of, 53
Voltage changes, membrane, in a passive dendritic tree, a non-uniform equivalent cable model of, 159

WARD, P. (see O'QUIGLEY, J.), 73
Water, doubly labelled; errors in the evaluation of oxygen isotope turnover due to temporal variation in CO_2 production do not always covary with dilution space estimate, 547
Water loss, insensible, through the eccrine sweat glands, an analysis on the rates and regulation of, 303
WEINBERGER, E. D. (see KAUFFMAN, S. A.), 211
WHITE, R. A., Computing multiple cell kinetic properties from a single time point, 429

YOUNG, R. A. and MARROCCO, R. T., Predictions about chromatic receptive fields assuming random cone connections, 23
YUAN, C. J., HOPFINGER, A. J. and JOHNSON, M. E., QSAR and molecular shape analysis of aryl-substituted alanine analogs as antigelling agents, 41